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L. O. HOWARD, Entomologist and Chief of Bureau.

PAPERS ON INSECTS AFFECTING VEGETABLES.

THE SOUTHERN BEET WEBWORM.

BY

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THE SOUTHERN BEET WEBWORM.

(*Pachyzancla bipunctalis* Fab.)

By F. H. Chittenden, Sc. D.,
In Charge of Truck Crop and Stored Product Insect Investigations.

INJURIOUS OCCURRENCES AND NOTES ON HABITS.

On September 24, 1906, the Bureau of Entomology obtained from Mr. F. W. Roeding, Wichita Falls, Tex., the larvæ, pupæ, and adults of the pyralid moth *Pachyzancla bipunctalis* Fab., which had been found operating on foliage of table beets in that vicinity. One larva transformed to pupa on September 25, and the adult issued October 3, the pupal period thus having occupied eight days in an average temperature of about 70° F. From this lot imagos continued to issue until October 2, and a larva matured October 10 which would have produced an imago about October 30.

During October, 1907, Mr. H. M. Russell observed larvæ at Dade City, Fla., on beet tops from 6 to 8 inches high, "webbing up" the leaves with the edges of the leaves folded together or joining two or more leaves to make a nest in which to hide. From this concealment they emerge and eat the leaf cells composing it, usually leaving the leaf skeletonized or very thin. In these nest-forming and leaf-eating habits the insect resembles the related Pyraustidæ. Mr. E. B. Embry, located at Dade City, Fla., stated that the larvæ of this species had injured the foliage of small beets so badly as to reduce his crop about 50 per cent. As late in the season as November 29, the webworm larvæ were found in another locality at Dade City, some of which showed parasitism. In January, 1909, larvæ were observed attacking beets at Boynton, Fla., and in March, beets at Miami, Fla.

From webworm material obtained October 18, one pupated October 23, and the moth issued November 8. Another larva pupated November 6 and the adult issued on November 21, thus indicating a pupal period covering from 15 to 16 days, in the latitude of Washington, D. C. In another case the pupal stage lasted from December 31 to January 22, or a total period of 23 days. The temperature at Washington was moderately cold.

This species was observed in 1908, by Mr. D. K. McMillan, at Brownsville, Tex., working in colonies on the foliage of pigweed (*Amaranthus retroflexus*), and on spiny amaranth (*A. spinosus*), the larvæ webbing and folding the foliage in the previously described manner. The colonies in question came under observation on April 30, May 14, June 15, and November 5, 1908. Mr. McMillan also observed the larvæ in large numbers during the spring of that year, working on "spinach" in the Rio Grande Valley and on beet foliage at Brownsville.

On May 28, 1909, Messrs. McMillan and H. O. Marsh observed these larvæ at Brownsville, Tex., embedded in the leaves of *Amaranthus retroflexus*. The larvæ were not in abundance at that time, doubtless owing to the extensive parasitism in May and June of the preceding year (1908). This was the first observed appearance of the insect that year.

During the same year this species twice came under the observation of Mr. H. M. Russell, in the first instance at Boynton, Fla., on January 27, 1909, when the larvæ were found in great abundance on the foliage of table beets. They had nearly stripped an early planting and were also abundant on a later planting. In many cases the larvæ were present on the underside of the leaves and had drawn the leaf into a fold, inside of which they were concealed. In other cases the larvæ were concealed by the folding up of the leaf from the edge, while in further instances two beet leaves were fastened together in such a manner that the larvæ were concealed between them. In feeding, the leaf substance is usually entirely eaten through to the surface, the leaf skeleton alone being left. The larvæ void a very soft excrement which produces a filthy condition of the leaves. Later on, March 3, the larvæ were found by Mr. Russell in fair abundance on beet tops at Cutler, Fla., and still later at Miami, Fla., on *Amaranthus retroflexus*.

Beginning with March, 1909, parasitic cocoons were seen on the leaves of beets, and early parasitism was indicated by the presence of parasitic cocoons on other food plants. Amaranth is abundant along the edges of many fields in southern Florida, and it is impossible to destroy it to a very great extent, as it grows luxuriantly on hundreds of acres of unclaimed lands. It costs from $15 to $75 an acre to clear hammock for planting. Perhaps, therefore, it is just as well to allow the amaranth to remain and to spray the weeds as a means of keeping this pest in check. There is little doubt that unless the parasites continue their good work the species is likely to cause a serious outbreak at almost any time in the future.

Of one lot of material received at Washington, D. C., the larvæ of which were nearly mature, it was noticed that they began to "spin up" preparatory to pupation on May 7; the following day some of

the larvæ had pupated and by May 20 the adults had commenced to issue, thus giving a total period for the pupal stage of about 12 days. The moths were placed in a large cage with a growing beet and at the end of the week all had died.

In other sendings of material the moths were observed to issue on May 25, June 3, and July 9.

The length of the egg stage was not ascertained, but it may be safely stated to be approximately 6 or 7 days, in moderate or warm weather. From eggs laid on June 5 and 6 the adults developed July 3, giving a total life cycle of 28 days, or 4 weeks, in hot weather, which will be about the minimum for the species. Assuming that

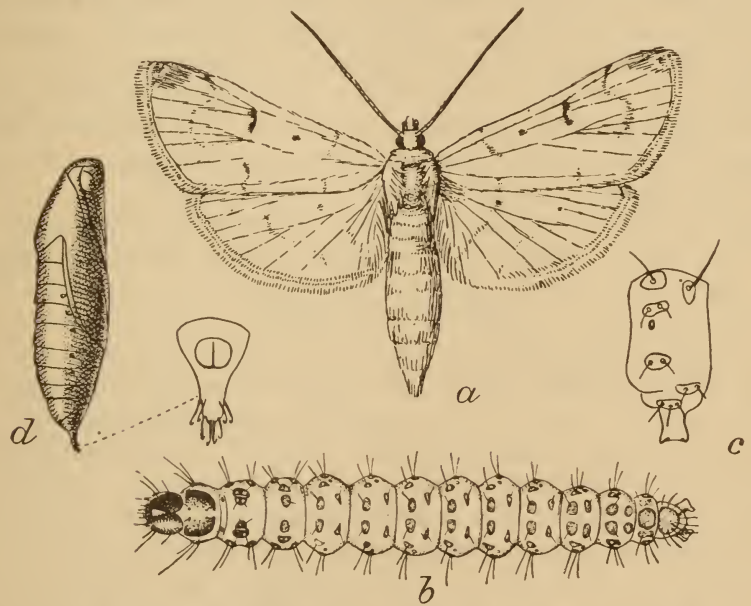

FIG. 3.—Southern beet webworm (*Pachyzancla bipunctalis*): *a*, Moth; *b*, larva; *c*, lateral view of first proleg and abdominal segment of larva; *d*, pupa, with cremaster showing location of hooks at right. *a*, *b*, *d*, About three times natural size. (Original.)

from 5 to 7 days is occupied by the egg stage, and approximately the same number of days for the pupal period in hot weather, the larval period would be approximately from 14 to 18 days. At least four generations are indicated for this species, and it is possible that there are more, but there are no positive data on record on this point.

DESCRIPTIVE.

The moth.—The moth in color varies from buff to very pale yellowish gray. The wings are slender and the antennæ long. In the pale forms the wings are nearly transparent, and the surface is rather iridescent purplish. The wing pattern of the pale individuals is faint, much more so than the illustration (fig. 3, *a*) would appear to indicate,

but is a little more definite in the dark forms. Near the anterior margin of the forewings there are three rather conspicuous black dots, one near the middle and one each side. The underside of the wings is paler and somewhat similar to the upper. The eyes are dark brown, nearly black. The abdomen is darker than the wings, and there are two black spots on the anterior margin of the third abdominal segment. The legs are long and slender. The total length of the body is less than one-half inch (12 mm.) and the wing expanse is about 1 inch (22 to 26 mm.).

The egg.—The egg is of irregular, short, oval outline, and considerably flattened upon the surface on which it is deposited. The color is pale yellowish, which looks green, owing to its semitransparence, permitting the color of the leaf to show through. The surface is finely reticulated, and under a high-power microscope is seen to be composed of minute, very irregular, moderately depressed areas, chiefly hexagonal and pentagonal in outline. The surface is rather strongly iridescent and glistens, presenting the appearance of a fish scale in miniature. Length, 0.6 mm.; width, 0.45 mm.

Eggs obtained in confinement, May 26, were deposited singly on the underside of beet leaves. Mr. Marsh also observed the eggs on the underside of amaranth leaves at Brownsville, Tex., June 22, 1909.

The larva.—The larva (fig. 3, *b*, *c*) is slender, cylindrical, and in the arrangement of the piliferous tubercles resembles *Loxostege similalis* Guen. and *L. obliteralis* Walk. The tubercles are not conspicuous in living specimens, but become prominent in preserved material. The color of the larva is dark, dirty green, with dark, mottled brown-and-black, or nearly black, head and thoracic plate, the latter widely separated at the middle. The dorsal piliferous tubercles are large and black, the two pairs being closely jointed. The remaining tubercles are large and infuscated, the dorsal ones transverse and arranged in two pairs, one pair on each segment. The tubercles of the last segment form a central plate, with a lateral one each side, in front of the larger anal plate. When boiled for preservation the larva becomes perfectly white, bringing into prominence the rings of tubercles which completely encircle each segment. The length of the larva when full grown is about three-fourths of an inch (19–20 mm.), and the width $\frac{3}{32}$ to $\frac{1}{8}$ of an inch (2.5–3 mm).

The pupa.—The pupa (fig. 3, *d*) is mahogany-brown, moderately slender, with the anterior extremity rounded, and the posterior prolonged into a bill-shaped cremaster, armed at the end with four very fine hooks, one lateral and two apical pairs, their tips strongly recurved. The abdominal segments are without spines. The length is about two-fifths of an inch (10 mm.).

The species is a pyralid and is placed in our lists next to *Loxostege*. It bears some resemblance to *Loxostege similalis*, but is considerably larger.

DISTRIBUTION.

This is without doubt a species of tropical origin and inclined to be cosmopolitan in any country suited to it climatologically. We have in the National Museum collections material from Pernambuco, Bonito Province, Brazil, as well as from Georgia, Texas, Florida, and the District of Columbia. It is recorded also from the West Indies and South Africa.

HISTORICAL AND BIOLOGICAL NOTES.

This beet webworm was first described as "*Phalæna 2-punctalis*," in 1794.[1] In the year 1880 the larva was observed feeding upon cauliflower at Savannah, Ga., where it was stated to be very destructive. In consequence it was given the name of "Cauliflower botis." [2] It was also noticed that it fed on ragweed (Ambrosia), which is probably the original food plant, cauliflower being an acquired one, and perhaps not a food plant under normal conditions. The following year it was again noticed at Savannah, Ga., on pigweed, the larvæ webbing the leaves together and destroying many plants. Nothing further seems to have been recorded of its habits.

NATURAL ENEMIES.

Phorocera erecta Coq., a tachina fly, was reared from this species in September, 1906. This parasite has been reared from the related *Loxostege similalis*, at Victoria, Tex.

Amorphota sp. near *orgyiæ*, an ichneumonid parasite, was reared January 15–29, 1908, from *Pachyzancla bipunctalis*, obtained from Dade City, Fla., in October and December of the preceding year. A single female [3] before the writer measures 8 mm. in length and is opaque black, with castaneous abdomen and middle and posterior legs. The fore legs, and the tibiæ and tarsi on the middle pair of legs are light yellow, as is also the first joint of the antenna, the remainder of the antenna being black.

Bracon sp., a small blackish species of this genus,[4] was reared from this host at Brownsville, Tex., November 21, 1908.

ASSOCIATED INSECTS.

In addition to the parasitic natural enemies of this species which have been mentioned, some interesting species have been reared. Prominent among these is a moth of the same family and with somewhat similar habits, known as the Hawaiian beet webworm [5] (*Hymenia* [*Zinckenia*] *fascialis* Cram.). It was reared by Mr. H. M. Rus-

[1] Fabricius, Entomologia Systematica, vol. 3, pt. 2, p. 232, 1794.
[2] Botis repetitalis Grote, n. sp., Comstock, J. H.—Rept. U. S. Dept. Agr. for 1880, p. 270, 1881.
[3] Chttn. No. 303[01].
[4] Chttn. No. 1064[01].
[5] Bul. 109, Part I, Bur. Ent., U. S. Dept. Agr., 1911.

sell, at Cutler, Fla., March 23–29, 1909. It is interesting to remark that Mr. H. O. Marsh has found this species very destructive to sugar beets in Hawaii, and has made a special study of it for the Bureau of Entomology.

An agromyzid fly was reared February 17, 1909, with this beet webworm from material received from Mr. H. M. Russell on beets and Amaranthus collected at Boynton, Fla.

Pegomya ruficeps Stein, an anthomyiid fly, was reared under practically the same conditions as the moth *Hymenia fascialis* Cram., above mentioned.

REMEDIES.

The remedies that have been advised for use against the garden webworm (*Loxostege similalis* Guen.) should be found about equally effective against the present species. In any case their use is advised until more is learned of the habits of the southern beet webworm. These remedies are given below.

Paris green.—Paris green is applied at the rate of 1 pound to from 75 to 100 gallons of water, or dry, distributed with a powder gun, as practiced in the South. The latter method, however, is inferior to spraying. Since the two species share common natural food plants (Amaranthus), the usual care should be exercised to avoid planting beets in fields which have grown up in this weed until after thorough fall or spring plowing.

The experience which Mr. H. O. Marsh has had with the related Hawaiian webworm conclusively shows the value of Paris green. He states, in brief, that a spray of Paris green at the rate of 2 pounds of the arsenical and whale-oil soap, 8 pounds in 100 gallons of water, proved absolutely effective and did no injury to the plants on which it was applied. The spray was applied to the underside of beet leaves.[1] More complete information in regard to this is given in Part I of the present bulletin.

It should be added that a mixture composed of nicotine sulphate, 1 fluid ounce, with whale-oil soap, 4 ounces, in 4 gallons of water, was used by Mr. Marsh against a number of noxious lepidopterous larvæ, and although this formula was not tested on the Hawaiian beet webworm, he believes that it would prove entirely effective.

Dragging the log.—In the case of a bad attack of the garden webworm in Oklahoma in 1903, a satisfactory barrier to migration was employed, consisting of a dust furrow in which a log was dragged. This might be used in case the webworm under discussion should occur in great numbers before its presence is discovered—something that is likely to happen, as in the case of species of related habits.

[1] For some reason arsenate of lead applied to both sides of Amaranthus leaves was found ineffective and no explanation could be made of this, but the chemical was probably not pure.